National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 342a

Nodular Cast Iron

This Standard Reference Material (SRM) is in the form of discrete irregular chips intended for use with chemical methods of analysis, including atomic spectrometry and optical emission spectrometry. A unit of SRM 342a consists of a glass bottle containing 150 g of chips.

The certified values for eleven elements are given in Table 1. The analytical methods used for the characterization of this SRM are listed in Table 2. All values are reported as mass fractions [1].

Table 1. Certified Values for SRM 342a

Element	Mass Fraction (in %)			
	I	II	III	Average[a]
Carbon (Total)	1.84	1.89	1.86	1.86
Carbon (Graphitic)	1.38	1.37	1.38	1.38
Chromium	0.035	------	0.032	0.034
Copper	0.134	0.139	0.131	0.135
Magnesium	0.072	0.070	------	0.070
	0.068			
Manganese	0.271	0.279	0.272	0.274
Molybdenum	0.003	0.007	0.007	0.006
Nickel	0.058	0.056	0.061	0.058
Phosphorus	0.018	0.018	0.020	0.019
Silicon	2.72	2.73	2.75	2.73
Titanium	0.020	0.020	------	0.020

Sulfur[b]	21.41 ± 0.96 mg/kg

[a]No changes have been made from the 1970 certificate for these elements. An uncertainty assessment was not done at that time.
[b]Recertified in 1999.

The overall direction and coordination of the technical measurements leading to the certification were performed under the chairmanships of O. Menis and J.I. Shultz.

The support aspects involved in the original preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by R.E. Michaelis. Revisions of this certificate were coordinated through the Standard Reference Materials Program by P.A. Lundberg and N.M. Trahey.

Willie E. May, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 1 September 1999
See Certificate Revision History on Last Page

Thomas E. Gills, Director
Office of Measurement Services

The certified value for sulfur has been determined by NIST using isotope dilution thermal ionization mass spectrometry (ID-TIMS). The uncertainty is expressed as the expanded uncertainty, U, at the 95 % level of confidence, and is calculated according to the method described in the ISO Guide [1]. The expanded uncertainty is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined effects of material inhomogeneity and within laboratory component of uncertainty. The coverage factor, $k = 2.23$, is determined from the Student's t-distribution corresponding to 10 degrees of freedom and 95 % confidence.

This certificate has undergone editorial review to reflect program and organizational changes at NIST and the Department of Commerce. Except for revision of the sulfur certified value, no attempt has been made to reevaluate technical data presented in this certificate.

PLANNING, PREPARATION, TESTING, AND ANALYSIS

The material for this SRM was furnished by the American Cast Iron Pipe Company, Birmingham, AL.

Cooperative analysis for certification were performed by the following laboratories:

I. NIST Analytical Chemistry Division, Gaithersburg, MD - J.R. Baldwin, D.A. Becker, B.B. Bendigo, E.R. Deardorff, P.D. LaFleur, G. Lutz, E.J Maienthal, R.C. Rains, and T.A. Rush.

Ia. NIST Analytical Chemistry Division, Gaithersburg, MD - W.R. Kelly, J.L. Mann, and R.D. Vocke, Jr. (ID-TIMS determination of sulfur).

II. American Cast Iron Pipe Company, Birmingham, AL - R.E. Deas, R.N. Smith, and J.B. Hobby.

III. Clow Corporation, Cast Iron Pipe and Foundry Division, Coshocton, OH - J.R. Boyd, R. Mast, and D. Jones.

Table 2. Analytical Methods Used

Element	Laboratory	Technique
Carbon	I, III	Combustion/gravimetric
	II	Combustion/volumetric
Manganese	I, II, III	Peroxydisulfate arsenite titration
Phosphorus	I	Molecular absorption spectrometry using molybdenum blue
	II, III	Separation/titration of ammonium phosphomolybdate
Sulfur	Ia	Isotope dilution thermal ionization mass spectrometry
Silicon	I	Gravimetry, double perchloric acid dehydration
	III	Gravimetry, perchloric acid dehydration
	III	Gravimetry, sulfuric acid dehydration
Copper	I	Isotope dilution thermal ionization mass spectrometry
	I	Molecular absorption spectrometry using diethyldithiocarbamate
	II, III	Molecular absorption spectrometry using neocuproine
Nickel	I	Molecular absorption spectrometry using dimethylglyoxime
	II, III	Gravimetry
Chromium	I	Redox/titrimetric after chromium separation
	III	Redox/titrimetric

Table 2. Analytical Methods Used (cont.)

Molybdenum	I	Activation analysis
	II, III	Molecular absorption spectrometry using thiocyanate
Titanium	I	Polarography
	II	Molecular absorption spectrometry using hydrogen peroxide (vanadium separated by sodium carbonate fusion)
Magnesium	I	Atomic absorption spectrometry
	I	Activation analysis
	II	Spectrography using solution rotating disk spark technique

REFERENCE

[1] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland (1993): see also Taylor, B.N. and Kuyatt, C.E. "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, U.S. Government Printing Office, Washington DC, (1994); (available at http://physics.nist.gov/Pubs/).

Certificate Revision History: 1 September 99 (revision of the certified sulfur value); 25 Mar 92 (editorial revision); 27 Apr 70 (original certificate date).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: Telephone (301) 975-6776 (select "Certificates"), Fax (301) 926-4751, e-mail srminfo@nist.gov, or via the Internet http://ts.nist.gov/srm.